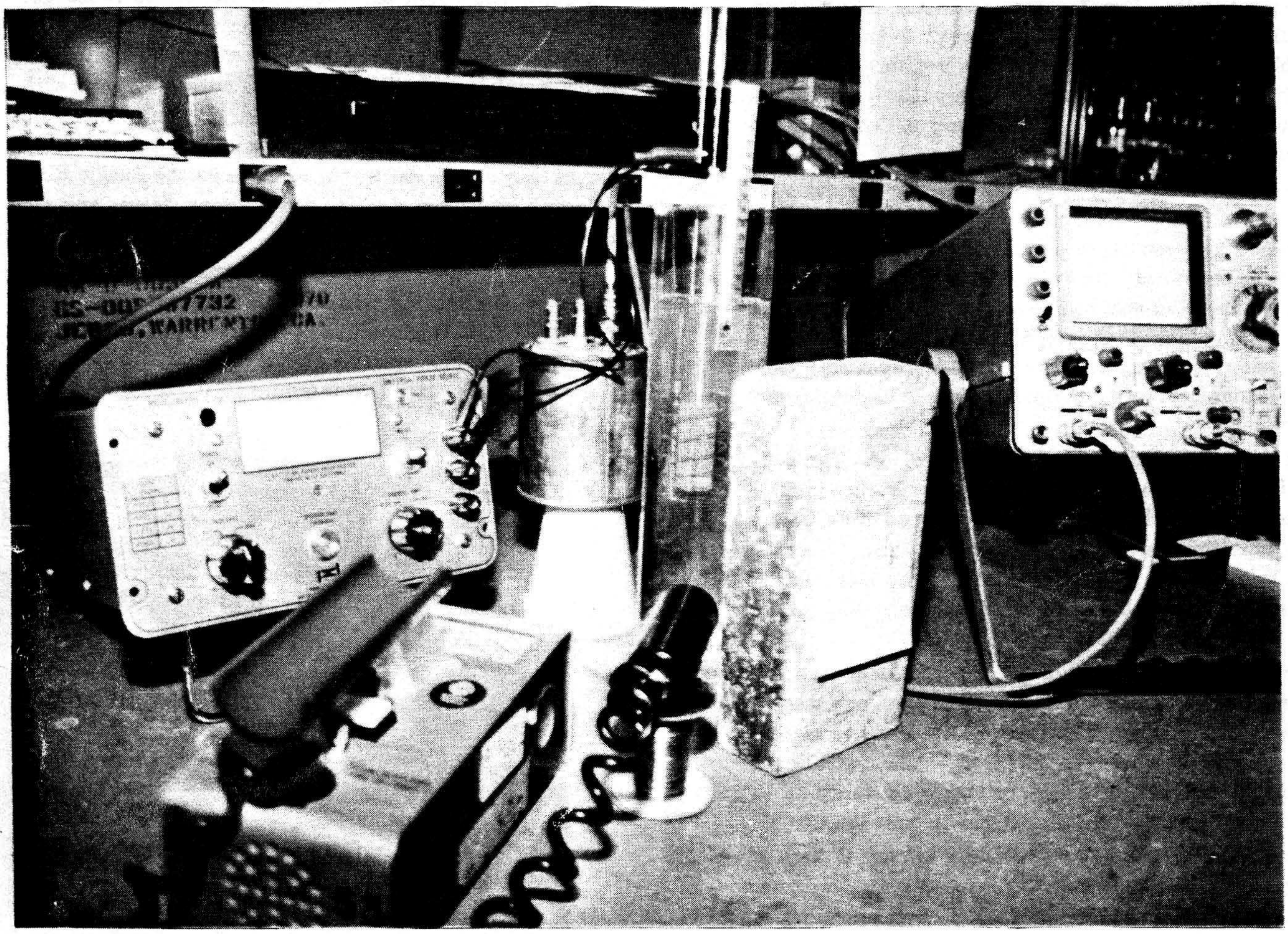
Pyrotechnics 42

The Now & Then Newsletter of General Technics

COLD FUSION: Hoax Revealed!



by Todd Johnson

What with all the excitement about fusion this spring, CW Robertson and myself (the people who brought you the antiproton collider Christmas tree) decided that we would have to take advantage of the situation. Some of our co-workers have always been suspicious that certain people are out to get them, and their suspicions were to be verified.

Our plot involved scrounging up some plexiglas tubing and a few other goodies and assembling a credible imitation of a cold fusion experiment.

A chunk of aluminum (who knows what palladium looks like, anyway?) was mounted on a rod and positioned inside a section of miniature slinky, and a cheap thermometer was glued to a plastic support. This assembly hung down into the plexiglas tube which was filled with warm tap water. A spare radiation monitor normally used to measure beam loss in the Main Ring was placed behind the tube and connected to a scope which had a pulse signal fed in from another source to make it look like it was doing something. Placed near the "cell" was a portable Geiger counter which had a small calibration source attached. The probe was positioned so that it was picking up a few counts per second from the source and emitting ominous clicks. A power supply and a single lead brick bearing a sign reading "Please stand behind this brick" completed the apparatus.

This was put together on a midnight shift with the intent of letting the boss notice it when he came in. Unfortunatly, he didn't come in that day, but the one other person we wanted to catch with it did. Momentarily shocked, he soon realized what we had done and immediately went in search of victims.

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Time Flies Like an Arrow

Guest Editorial by Jeff Duntemann

Time flies like an arrow—except that arrows *slow down* as they go. But time... wow, time goes faster and faster with every passing year. Hard to believe General Technics is 13 years old. Harder still to believe I've been away from it as long as I have. Perhaps hardest of all to believe is that the Chicago gang have finally gotten it onto a firm footing by doing what no one else has ever tried to do: *charge* for it!

What a thought. But if it works, let's do it. And more important, let's not stop.

For those of you who've just tuned in, I was the guy who used to put together *PyroTechnics* via Tabletop Publishing—where the only software is the gooey stuff on the corner of the table from yesterday's lunch that you forgot to wipe up before sticking a Jeff Tolliver cartoon in it. I think I put about twenty of them over a five year period, of which I am very proud.

This was in the period 1976-1981. I gradually got busier and busier trying to make my way in the world, and the time period between *Pyros* got longer and longer until it sort of tended toward infinity... does that sound familiar? A lot of us had and still have that problem. Being in college and living in a cardboard box by the railroads tracks is a lot easier in many respects than keeping a high-tech job and a four-bedroom house full of dogs, computers, and resistors.

But we gotta come back, really. All of us. The bat-signal is on the clouds; the Commissioner is shouting on the phone; the world's in deep doo-doo and we'd better put on our leotards and rev up our jetpacks. Like Doc Brown said in *Back to the Future* while he was stuffing old banana peels into Mr. Fusion: "You? No, you're fine... it's your *kids* I'm worried about!"

The kids. Yup. Carol and I have not yet punched the Replicate button and probably won't, but it's sobering to note that we have friends our age whose kids are hitting puberty. This is where ya gotta grab 'em and stick a quarter-inch drill in their mitts, or they'll all march off to law school and start suing each other for a living.

The kids are not building. The kids are not tinkering. The kids, by and large, don't seem to be giving a damn. The kids are not becoming ham radio operators; they're not building robots; lord knows they're not wire-wrapping their own computers. If they don't get to it the Japanese are gonna just buy the whole country and tuck it in a museum somewhere by 2000.

There are two problems here. One we can fix; the other, well... let us pray. First things first. The kids aren't rolling their own technology. Why not?

Well, why *should* they?

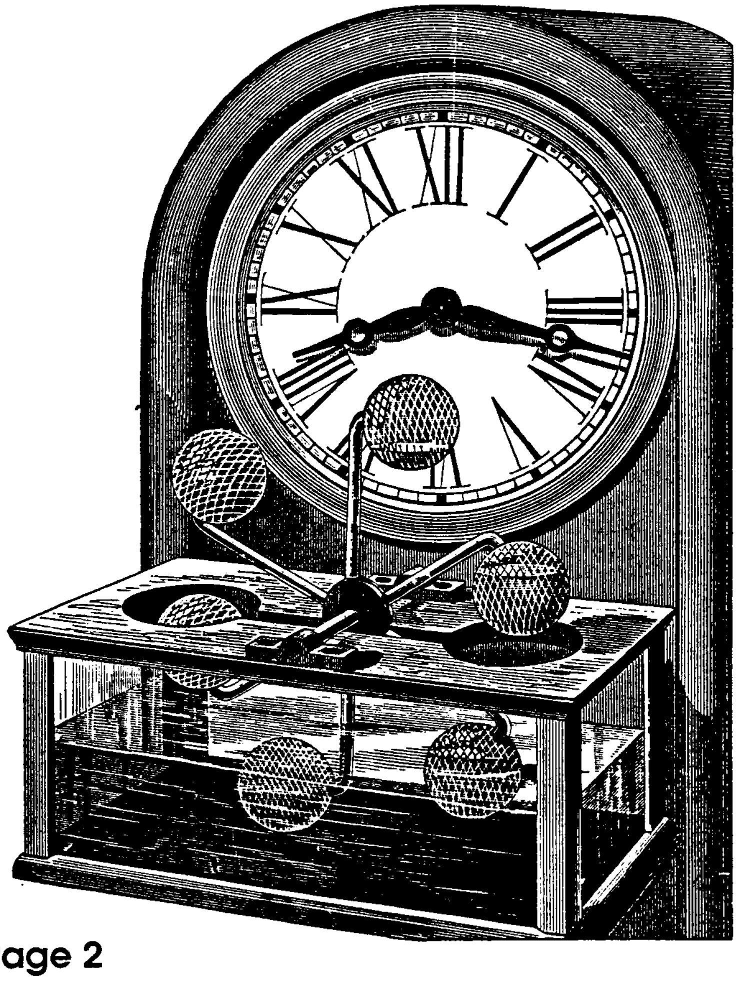
I saw a couple of 13-year-olds in the empty lot down on Navarra Drive the other day, running a magnificent radio-controlled jacked-up pickup truck through the weeds, whipping it up and down these little dirt hills, jumping it through the air, making hairpin turns that I was sure would destroy the gadget.

But no—the kid was good, his reflexes trained in the best Pac-man fashion, spinning the little steering wheel and punching buttons on the control box like a pro. And the vehicle itself was superb. It was doing all that any robot we ever built did, except that it didn't have a face with rolly eyes. If you can go to Radio Shack and buy this stuff for the equivalent of a month's work at Burger King, why should you spend a thousand hours putting it together from scratch, and have it just fall over and ding itself up trying to get over a dirt bump?

You can get an all-band shortwave radio for $75, brand new, with a built-in cassette deck and weather channel. Why should a kid sweat over a one-FET regenerative receiver that can pull in Radio Moscow on a good day with two hundred feet of wire in a tree? Flip the switch and you get Radio Brungaria at 20db over 9.

I guess you could say that kids should do it for the practice and the education, and you're right—but from my own experience I've found that nothing makes the experience sink in and stick like coming out of a project with something that you can use to do a job you couldn't do before. And if nothing you can possibly do can equal the gizmos they stamp out by the millions on the Pacific Rim, it doesn't make you want to roll up your sleeves and dig in.

We blinked LEDs back in 1976 because LEDs were new and novel and nobody else had them. Nobody's building Trekkie blinkers anymore; not even the damned Trekkies. Now they have the cigarette girls in Las Vegas selling sunglasses with LEDs flashing marquee-style around the rims for twenty bucks.



The kids say, and rightfully so, that It's Been Done.

So what we have to do, obviously, is look for interesting technology that you can't buy in a can at Radio Shack. This may mean, regretfully, that we have to de-emphasize electronics. The Japanese have indeed done electronics to death, to the point where even something as miraculous as a handheld video studio (which I bought not long ago in the form of a Sony SP-7 8mm HandyCam) gets boring after a few days.

That leaves a lot of room, however. When I was 13 I built an 8" telescope by grinding two disks of glass together, and then bolting together a square tube out of plywood atop a mount made of screwed together rusty pipe fittings. Yet when I first turned it onto M13 and saw the cluster explode into ten thousand tiny specks of light, tears flooded in and ruined my night vision.

You still can't touch an 8" scope for the price you can build one yourself. You can't make modern synthesized radios out of old TVs anymore—but you can still make a magnificent telescope out of trash and sweat. I put together a wide-field refractor last month out of an old surplus IBM Copier II lens and five 3" ABS plastic sewer pipe fittings. Total cost: $30. Time spent: One evening. And yet it makes the sky sing with light that was born when Man had barely learned not to be afraid of the dark.

I have other technologies to point out, crazy ideas and good ones, and I'll share them with you in this, our resurrected *PyroTechnics*. But before I do that, I want to point the finger at the other villain blocking our way.

I first encountered him back in college, while reading *The Stranger*. The prof was telling us that the protagonist was to be executed because he had dared admit that he had made love to his girlfriend the morning before he shot a stranger to death. I quietly suggested that murder was evil, and that the damned fool deserved the guillotine and worse. The prof was pretty upset. I dug myself in deeper by accusing Camus himself of being a coward who was so afraid to care about anything that he claimed that nothing mattered at all, not even murder. The other kids around me sort of rolled their eyes as if to say, What planet did this guy come from?

That's it, that's him: Call him Cynicism; call him Sophistication; call him what you like, but I call him Cowardice, and worse. Our children are infected with a bug that whispers in their ears that Nothing Matters, that Everything Is Equivalent, that Only Geeks Get Enthusiastic. It's that all-pervasive compulsion in our culture to be cool, to be suave, to be flat- eyed and flatlined with lips curled in slight amusement at all the rest of the universe.

I've always violated that compulsion at every turn, and so do most of the people in our organization. I used to work at a place run by posturers who smiled condescendingly at my childlike enthusiasm and—horrors—my daring to care about our craft and our industry. What *really* mattered was understanding the nuances of fine wine—a good year; sprightly but not bitter; winsome with a touch of prevarication; ahh, dry, never dry enough.

Pfeh. Vinegar is vinegar, guys. Cut the crap already. Or pass the freaking sugar.

The problem is this: We look down our collective noses at those who get too gushy, who love too hard and care too much, who feel that quality matters and that there is such a thing as right and wrong. So why the surprise when the kids put on their shades and curl their lips in phony amusement when we suggest that there is corny stuff like wonder and skill and accomplishment in the world?

It's all the easier for kids to do because it provides an easy shield from having to face the messy stuff. It's harder to say The Buck Stops Here than to say There Is No Buck. It's easier to say that nothing matters when you're too chicken to care about the stuff that does.

This is more than a problem with General Technics; it's a problem with the entire American culture. What we must do is teach kids that there is good and evil, quality and crap, ambition and sloth, responsibility and cowardice, and that the two ends of everything are *not* equivalent. It's been made all the harder by the fact that the pond scum on the far right have said things like this, but you must realize that the Right says what they do because the Left have vanished behind their sunglasses, and the Right have no existence except in reaction to the Left.

It's time to care, and to teach the children to care, and furthermore that it's OK to gush and enthuse and be manic about the things that count.

Once they care, they will build.

Promise.

Back Issues

For Details, refer to Page 8...

PYROTECHNICS
REPRINTS AND ORIGINAL BACK ISSUES

(Prices are based on number of pages and cost to mail. Include an extra 35 cents in stamps for each back issue if you wnat them sent in envelopes.)

Issue #	Type	# of 25 cent stamps to send:
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#23	Original	4
#24	Original	8
#25	Original	6
#26	Original	6
#27	Original	4
#39	Original	4
#40	Original	6
#41	Original	4

If you order an issue that we're out of, we'll send your stamps back to you.

Land of the Lost...

We need current addresses for the following persons. If they are still 'lost' after Issue #44, they will have to be dropped from the list.

Ed Curtis
Avery Davis
Ed Hanley
Sherry Katz
Mike Mahaffey
Bill Nunne
William Seligman
John Upton
Michelle Donat
James Lawson
Doug Mallinak
George Popa
Jeff Vogel
Ben Zuhl
Craig Ledbetter

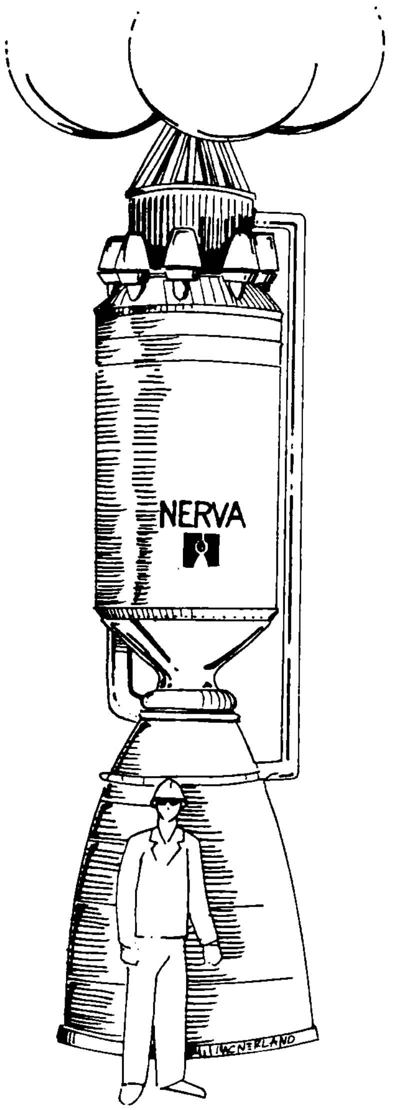
Dr. Techie's Lost Technologies of the 50's

George M. Ewing

Over the last few years, there has been a building wave of nostalgia for the Fifties. We've had conservative Republicans in the White House, relatively low gas prices, and on the world scene, "there's been fighting in Africa, and strife in Iran." Following on the success of *Back to the Future*, we've had a rash of borderline SF Fifties movies, and the TV commercials are filled with pop songs from the Fifties and early Sixties (Culturally, you can make a case that the "Fifties" actually ran until about nineteen sixty three - nineteen sixty four, when a number of mileposts appeared, I.E. I graduated from high school, Kennedy was assassinated, the Beatles started becoming noticed, outside Liverpool and Hamburg, etc. Lots of pop culture hits thought of as "fifties" nostalgia, from *Happy Daze* and *Animal House* to *Laverne and Shirley* and American Graffiti were actually set around nineteen sixty three.) Besides all the campy pop culture impedimenta from the fifties, the hula hoops and Davy Crockett stuff, there is also renewed interest in the explosive technological boom of the period. The nineteen fifties were a time of phenomenal growth in science, with milestones like the discovery of the structure of DNA, the development of the transistor, the solar cell, the artificial satellite, and the first beginnings of manned space travel. In addition to the big 50's milestones, like Sputniks, H-bombs, and atomic subs, and the more mundane technologies, like color TV, Polaroid photography, and the Xerox machine, there were myriad techie developments that never seemed to quite make it. You read about them in *Popular Science* and the newspaper Sunday supplements, and great breakthroughs were always just around the corner, but somehow they never quite fulfilled their promise, though SF writers of the period used them heavily in near-future backgrounds. I cornered the famous 'Dr. Techie' at a recent SF and Fantasy convention in Florida, and asked him about some of the ones I could remember from my own Fifties childhood. It was the most fun I'd had pestering an expert since I got into (and lost!) a convoluted argument with John W. Campbell at the 1966 Worldcon about the Farrell Drive, or the time they invited a bunch of GT people to lunch in the center of the main neutrino beam at Fermilab, and we spent most of the time arguing about World War I zeppelins and the possibility of scrounging radioactive steel shot from a particle detector for homemade 12 gauge duck hunting reloads. I found Dr. Techie in the con suite bathroom, watching a couple of concom members mixing a fresh batch of Blog in the bathtub. The room was murky with CO_2 from the dry ice, and he was swapping good-natured lecherous remarks with a couple of tall, willowy, albino women in fantasy costumes from a central Florida SF group. As an SFWA member, I have a pretty good idea of the doctor's real name and occupation, but of course I have promised not to reveal it. However, he is NOT: A. Isaac Asimov, B. James Corum Whiting, C. Christopher Anvil, D. Forry Ackerman, or E. Anyone connected with the Duck's Breath Mystery Theater! As we had been talking about atomic rockets for some time in the con suite following a long discussion of the nuclear steam rocket in Robert Heinlein's film, 'Destination Moon,' it was only natural that this would be the subject of my first lost technology question...

GME: "What ever happened to REAL atomic rockets?"

Dr. T: "Disregarding what the Soviets were working on, there were two programs in the U.S. that were significant. The more widely known of these was project NERVA, which actually extended into the 1960's. It was based on a long-path, axial flow reactor, with relatively large diameter gas tubes, more than a meter or so long, arranged in cells with a hexagonal cross section. It worked fine, but the conservative design made it heavy, and relatively inefficient. NERVA's specific impulse was better than chemical rockets, but the internal turbulence in the large passageways hurt efficiency, and the thrust-to-weight ratio was not as good as modern chemical rockets; you'd probably never be able to launch a NERVA rocket from the surface of the Earth into orbit, even if the environmentalists would let you, but it would make a pretty good orbital space tug or shuttlecraft for trips in cislunar space, and lunar surface landings and takeoffs would be possible." "A more tantalizing project for space advocates is the DUMBO technology, developed in the mid-50's at one of the Los Alamos nuclear weapons laboratories as part of a secret research program. DUMBO utilized RADIAL flow heat exchangers with a



very short path, only a centimeter or two, and a tiny passage diameter, almost microscopic in size to provide laminar flow and to reduce turbulence. Dumbo was much lighter and more efficient, with a specific impulse that was similar to NERVA, but with a thrust-to-weight ratio about an order of magnitude better. Direct launches from the surface of the Earth to orbit were perfectly practical, though probably only for large, unmanned payloads, because of the shielding requirements for a manned mission. "The exhaust was only slightly radioactive; One estimate, in Donald Kingsbury's 70's Analog article on DUMBO, (12/75, p.38--GME) was that you could put nearly a thousand Skylab-sized payloads into low Earth orbit for about as much radioactivity released into the environment as one of the 50's Pacific island weapons tests. DUMBO engines were also easily throttleable. Probably the main reason we aren't using them today, besides the generally anti-nuclear political climate, is that the program was victim to political rivalry from NERVA, the "not-invented-here" syndrome, and competition from the big chemical rocket companies, who had a lot of money at stake, and powerful friends with a lot of clout in both NASA and the military missile programs.

GME: "Didn't DUMBO have ANY shortcomings? It sounds almost too good to be true!"

Dr. T: "Well, I'd like to see some more information on engine lifetime. NERVA was big and heavy, but probably would keep on running for years, so long as it could get reaction mass. The nuclear fuel in DUMBO was bonded to a tungsten/nickel cermet substrate in thin layers. I expect it would be used up rather quickly, and because of the way it was built, recycling and processing spent uranium fuel from a DUMBO engine might be extremely difficult, if not impossible. Treating the engine as expendable after so many hours is perfectly reasonable, but raises potential problems with secure waste disposal and so forth. Of course, a lot of the details on DUMBO are probably still classified, or at least they were in the mid-70's. I surely hope the SDI people haven't forgotten about it.

GME: "Why do we have to use rockets at all to get into space? Why can't we use the Dean Drive, another one of those great lost inventions of the 50's?" (There was a short interruption here as several of the older fans in the con suite began chanting, "The Dean Machine! the Dean Machine! You put it in a Submarine!"...etc.)

Dr. T,(laughing): "First of all, just like NERVA, the Dean Drive continued on into the 1960's; the famous Analog article with the flying submarine on the cover was in the June, 1960 issue, I believe, while the magazine was still changing over from the old 'Astounding' title. "Second, the main thrust of Mr. Campbell's argument was not on whether the Dean Drive would work, but that scientists and government officials automatically dismissed Dean as a crackpot, another Velikofsky, without bothering to actually watch a demonstration.

GME: "Well, did the Dean Drive actually work? Norman Dean got a patent on it, didn't he.?"

Dr. T: "I'll answer that with a question for you, Mr. Ewing: Did the Farrell Drive at Michigan State Really work? There's a valid patent on that, too, and you were there."

GME: "Well, yes, but..."

Dr. T, (interrupting): "Exactly! 'Yes, but...' Of course the Dean Drive, and the Farrell Drive, and that secret Marine Corps drive that was on the cover of Popular Science Magazine all work, but they're NOT space drives; they're static friction devices. The difference between static and dynamic friction causes a one-way ratcheting action, just like the effect of a good ski wax on cross country skis. They work fine for pulling a piece of farm machinery out of the mud or running a military landing craft up on a beach, but in a zero-friction state like in space they just sit there and buzz and shake. Next question..."

GME: "Okay, as long as we are talking about 50's things that could have flown, or that people claimed could have flown, how about something that really did fly: what about the flying wing?"

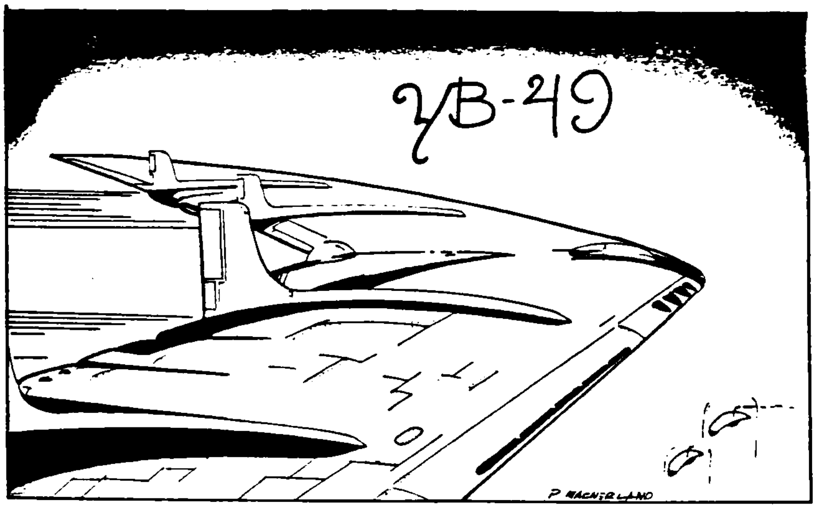
Dr. T: "Ah yes...The flying wing technology was around for a while before the 50's, of course. Most fans have seen the models used in H.G. Wells' 'Things to Come' in the 1930's, and those were based on real designs. Both the British, and Northrop Aviation in the U.S., had flying prototypes during the Second World War, propeller driven, of course. The Northrop model looked a great deal like the phony German aircraft in the first Indiana Jones movie, though I think the wingtip stabilizers were different. Of course, the Northrop plane was first operational around 1944 or so, not 1936, but jumping the gun eight or ten years doesn't bother Hollywood; they had 1940's German **Panzerfaust** bazookas and type-VII U-boats in that movie, too, long before they were really available.

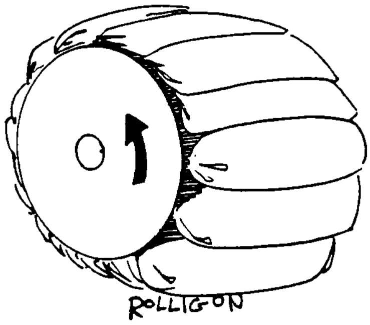
GME: "Yes, but when most SF fans think of flying wings, they think of THE Flying Wing, the jet one from the movies. Everyone has seen that clip from the film, *'War of the Worlds'* where they drop a nuclear weapon on the attacking Martians...

Dr. T: "Yes, I know; I think its designation was B-49 or YB-53, or some such. You'd have to check with a real aviation buff at Wright Patterson or the Smithsonian. It was really a late 40's design, though. There were several designs competing for a strategic bomber to replace the B-29 and B-36, The flying wing from Northrop, the B-52 from Boeing, and a similar conventional design from Convair. The B-52 finally won out, of course, and the darn things are still flying. The flying wing had about a 20% payload advantage over the B-52, but was somewhat tricky to fly. Also, there was a crash early in the program. The best guess is that the Air Force picked the B-52 because the SAC generals thought it would be more fun (and safer) to fly, and had built up a big loyalty to Boeing because they'd all begun their careers flying the B-17 during the war. "Anyway, a first batch of 35 or so flying wings was actually built, then the whole program was scrapped, and the planes allegedly destroyed. John Northrop claimed in a TV interview later that it was all Pentagon politics, and that somebody, either the Secretary of Defense or the Secretary of the Air Force, had a grudge against his company, or else was wheeling and dealing to try and force a merger of Northrop with Convair, or the company which later became Convair.

GME: "Were ALL those 35 flying wings actually destroyed?"

Dr. T: "Probably, though it's fun to speculate. The flying wing had another advantage over the B-52, besides the 20% payload factor, one we are only beginning to appreciate a generation later, namely a greatly reduced radar image. In fact, artist's sketches of today's STEALTH bomber designs look a hell of a lot like it. Suppose a few of those planes weren't destroyed, but went on to make secret spy flights in the 50's over Soviet and Chinese territory; that might explain the rash of UFO sightings from those years that often described a big, silver, boomerang shape... Maybe somebody from the CIA or the Skunk works will eventually spill the beans, and we'll all know for sure! (There was a another brief fannish interruption here, with a jumble of questions about other real and imagined projects from the 50's and early 60's from a number of bystanders.)





Dr. T: "Okay, okay, one at a time... First, the gentleman in the chain mail was asking about project MOUSE and the IGY. You know what the IGY was?"

GME: "That's easy: it was the International Geophysical Year, an extended period of co-operative science projects for about 18 months during 1957 and 1958. I remember reading in National Geographic about a lot of bases in Antarctica."

Dr. T: "Not too shabby. What can you tell me about that? it was called 'Operation Deepfreeze'...

GME: "Well, the high point was probably the first plane landing at the physical South Pole since the Byrd expedition. A Navy R4D, essentially a DC-3 with skis, landed right at the pole. The name of the plane was the 'Que Sera, Sera...' But back to project Mouse. wasn't that some kind of satellite?

Dr. T: "Hey, the youngster has been doing his homework! Probably just leafing through the back issues to leer at all the topless third world native T&A, eh?, Yes, Project MOUSE was a satellite. The acronym stood for Minimal Orbital Unmanned Satellite of the Earth. SF writers like Arthur Clarke and George O. Smith had been playing with satellites for years, but the MOUSE project, I think it was in Life magazine, was one of the first mainstream pre-Sputnik satellite proposals. If they'd gone ahead and built it, and then unleashed Werner Von Braun at Huntsville, the U.S. probably could have beaten the Russians into orbit by a few months, maybe a year or more. What was the next one? project Farside?

GME: "Yeah, what WAS project Farside?"

Dr. T: "First of all, it didn't have a damn thing to do with the far side of the moon. It was a program for testing nose cones and ablative heat shield material. They took a multistage rocket up out of the atmosphere, and then fired the last stage straight down into the atmosphere again. Mostly for missile nose cones, of course, but the designs they developed saved a lot of weight on the manned shots, especially Apollo. In the early days before Farside, most scientists didn't think it would be possible to return straight from lunar orbit and slam right into the Earth's atmosphere without a lot of heavy retrorockets, or a heat shield so massive that it wouldn't be practical. They were wrong, of course.

GME: "The young lady in the silver rat suit asked about SNAP."

Dr. T: "S.N.A.P. was the general name for a whole line of small nuclear power generators for satellites and unmanned spacecraft. Some of the smaller ones were just little isotope heat sources driving a bank of thermocouples; some of the bigger ones were actual reactors, with adjustable beryllium reflectors and thermionic generators, and Esaki diode inverters to step up the low voltage for electronics packages and ion drives. I think the power source for the Apollo instrument packages they left behind was an isotope thermal type.

GME: "This discussion is getting awfully lopsided towards space and aviation, and we haven't even gotten to the flying platform, The Chrysler Aerospike, the jet seaplane, and Project Pogo yet. What about the more mundane lost technologies, like the Rollagon truck, fluidics, and the PFA carburetor?

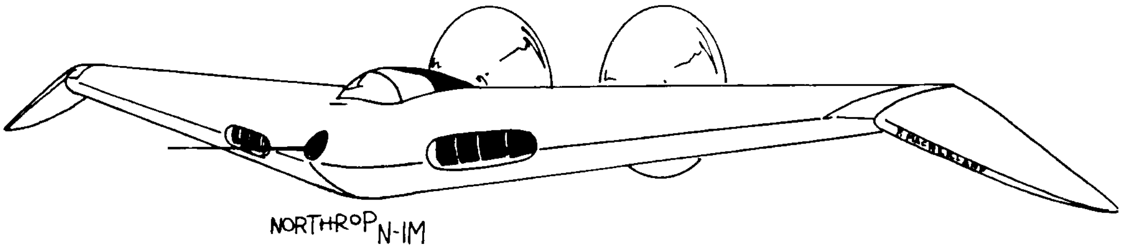
Dr. T: "Some of those are really from the 60's or even later. What about the Rollagon truck? Well, it was a cross-country vehicle that used big, soft, cylindrical airbags instead of tires. Propulsion was by means of friction rollers instead of torque through the hubs. They worked okay, but there were lots of little picky engineering and economic problems. There was a problem with heavy mud and dust getting into the drive rollers, for one. The bags were pretty durable, but when they did fail, they were expensive and troublesome to replace. Since the actual vehicle was never really mass produced in large volume, the poor economy of scale put it at a disadvantage with more conventional trucks with standard off-road tires, which WERE mass-produced by the millions. A modern truck with big off-road tires can go almost anyplace a Rollagon could go, and you can also drive it sixty miles per hour on the freeway.

GME: "I think the next question was on Project Pilgrim."

Dr. T: "That was a fictional project in the Saturday Evening Post about a cheap-and-dirty one-way moon shot that ran in the Sixties. It wasn't a real project, though there were serious proposals for doing something like that, soft landing a number of canisters of supplies at a spot on the moon, and then sending a man on a one-way trip, to live there for a few years until he could be picked up by an Apollo mission. It was considered too dangerous, though later Apollo missions were able to land within a few hundred meters of of a downed Surveyor spacecraft. Digging in deep enough on the lunar surface to be safe from solar flares while wearing a clumsy spacesuit would probably have been the toughest part. Anyway, back to the Fifties...

GME: "What about the Flying Platform?"

Dr. T: "What is this, a secret front organization for the Confederate Air Force Ghost Squadron? All right, All,



right... The flying platform, as opposed to the hovercraft, was just a big ducted fan with a sewer grating on top. You stood on the grating, gabbed a handlebar or a railing about belt high, depending on the design, and flew the thing by leaning your weight and tilting the platform. The Army played around with them in the 50's and early 60's, along with other aircraft like the COIN, and the inflatable rubber airplane. Anyway, they worked okay for flying along over swampy ground and level terrain, so long as you stayed low, within a few feet of the ground, and could pick up some ground-effect cushion. If you were careful, it was just like operating a narrow, tippy, but very fast hovercraft. However, G.I.'s tended to do things like fly them into a mangrove thicket at seventy miles an hour, or take them up to five thousand feet, where they were very unstable and dangerous. At any real altitude, flying them was like balancing on a unicycle. A real expert test pilot, like a Chuck Yeager or an Iven Kincheloe could probably fly them safely, but putting a bunch of hotrod infantrymen on them was just asking for trouble...

(at this point, there was another interruption: Dr. Techie was just starting to explain the inflatable rubber airplane, when two voluptuous young fannish women wearing black fur bikinis and moose antler skull caps came into the con suite bathroom, grabbed him by the belt buckle, and dragged him off down the hotel corridor for some panel that was about to start; at least they SAID it was a panel... Anyway, next chance I get, I hope to interview the Doctor on some more modern technologies of interest to SF fans, such as the synchronous skyhook, the Moravec pinwheel, stochastic precooling of antiprotons, the Kleiner blinkie, and stuff like that...)

The day I became an Auto-Didact

Book Review – Annette Kavanaugh

When I was younger, I really resented school because it took a big bite out of my reading time. If you nod at this and say, "Me, too," I have a found the book for you. Kendall Hailey, age 15, decides she's had it with the educational establishment on the June day when her school sends out a mandatory summer reading list, and she realizes that they are going to tell her what to do with her summer reading time, as well as the nine months a year to which they have already laid claim. She sets about liberating herself from high school (by way of early graduation), and gets permission from her parents to spend a year educating herself before setting off to college.

The first clue we have that Kendall's family is somewhat unusual is that when she asks for one year off before college, they say, "Take ten." Her mother is a novelist and her father a playwright; she talks with considerable nonchalance about taking time off from school to accompany her parents on book-promotion tours. Other kids' fathers complain of a rough day at the office; Kendall's father worries over a play that has too short a run on Broadway. Both parents have the writer's suspicion of critics and academic "how-to" courses, and both are happy to recommend their favorite novels as a starting point for their daughter's self-education.

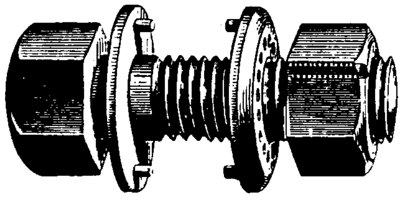
This book isn't just a reading list, though; it's the story of an education. Kendall writes with equal passion (and equal irreverence) of the things that she dislikes about Famous Dead Writers and the things that annoy her about her little sister; here is a person to whom intellect and "real life" are equally real and equally important. She is fond of her family (and rightly so, given the engaging portraits she draws in the course of her story), even though their various eccentricities annoy her; she writes with candor about family squabbles major and minor (her parent's health problems, her beloved uncle's brain surgery, the aforementioned sibling spats).

Listening to Kendall Hailey talk about books (and "listen" is the right word, for her style is quite conversational) is like hearing a friend answer the question "What are you reading these days?" She reads voraciously, and takes on a lot of volumes that would be on anybody's Great Books list, but she doesn't talk like a critic. A great part of this is that she is a writer in training, and treats Tolstoy and Dickens and Flaubert as her colleagues, not as minor deities. She tells about her writing projects, and complains of how dreadful her plays and novels seem on second reading. She watches movies from the 1930s on TV, and writes her own screwball comedy. She goes to a playwriting workshop with her father, and wonders if her plays will measure up to his standards.

One of the most charming things about this book is its unselfconscious and wholly successful use of the present tense. Reading it, one really does feel as though one were engaged in a conversation with a person of singular passion and lack of pretension. We don't know if Kendall Hailey turns out to be a Great Writer; her story isn't finished yet. For this reason, her book has an appeal which memoirs of the famous do not: it is the story of a young person, told by the young person herself, not by her older incarnation fifty years hence.

Furthermore, I'll confess that at least half the books Kendall read I've only heard about, never read -- and I'm almost twice her age. Even though most of us do not have the leisure time she does, it is exhilarating to think about how much remains for us to learn -- and how we can start learning it today, in the privacy of our own armchairs. By the way, I'm not giving away too much by saying that she finally decides not to go to college; her suspicions about formal education are confirmed by her friends' letters home, describing social miseries and tedious classes, both not all that different from those of high school. And this, of course, makes me wonder if my third grade self wasn't right about school after all.

Annette Kavanaugh is a graduate student in mathematics.
The Day I Became an Autodidact *was a 1988 Bantam paperback.*



Quarks

Life imitates Japanese animation: Brett Bellmore AKA Morf the Chaotic likes the idea of Mile-HiCon's 'Critter Crunch', (see Quarks in issue 41) but doesn't want to go all the way to Denver. He'd like to start a letter writing campaign to "persuade the Minicon folks that a creature crunch would be a nice addition to Minicon". Any takers? Has anyone out there seen a 'critter crunch'? He has also learned of some clarifications to the rules:

1. Internal combustion powered critters are allowed, so long as they are propane fueled and have tip switches to kill the motor.
2. The creature only has to be able to fit in the one foot cube at the time it's being checked. If it unfolds under its own power afterwards, that's just fine.

Just in case this cold fusion stuff doesn't work out... Joel Davidson of Heliopower Inc. has written a Book on photovoltaics. He'll send a copy for $15.00 post paid to anyone who mentions pyrotechnics. Mail to Heliopower Inc., P.O. Box 5089, Culver City, CA 90231. Joel helped design SUNRUNNER, a solar powered vehicle which holds (according to the 1986 Guiness Book of World Records) the world land speed record for a solar powered vehicle.

If you think you've been frustrated trying to find out about cold fusion, pity poor Charles Galway. Charles is at the University of Utah and writes "as far as I can tell, virtually nobody outside the inner sanctum has any significant knowledge (outside their own personal education)". This isn't how they told me science was supposed to work.

Bill Higgins, one of the editors of this rag, is rapidly becoming a high muckety muck in the 'back to space' movement. He's running a rather large space conference in Chicago at the end of May. The strain is beginning to tell. When I called him on May 6 and asked how he was doing, he paused for a few seconds, then yelled "TWENTY DAYS!"

Cathy Hudson, who assures us that she has had no "terribly unique" experiences, has been raising cats, directing a choir, learning to play the organ, pursuing her agronomy hobby by trying to restore a few acres to natural prairie, and attending UNIX wizard school. All this has left her no time to polish her flying skills past the solo level. Sounds dull and boring to me...

Most of us know that jet aircraft cabins are pressurized so they can fly at altitudes where people can't breathe. (Having your customers die of anoxia is bad for repeat business.) But the cabins are not pressurized all the way to sea level pressure. I guess they would be even more inclined to pop open in flight if they were. Captain Al brought a mountain climbers altimeter with him on a flight from Boston to Cleveland and recorded the cabin pressure (in terms of equivalent altitude) every few minutes during the flight. Within twenty minutes of takeoff, the pressure dropped to the equivalent of 8000 ft. and stayed there for about an hour. Now, human beings have no trouble breathing at 8000 ft. but they do take a while to adjust. This is probably why you often feel drowsy on long flights. Consider two things:

1. The pilots aren't wearing oxygen masks.
2. Our political and business leaders fly a lot. I wonder about the cumulative effects of repeated mild anoxia on members of the former administration...

We also heard from: Henry Spencer
Mark Kobrak
Paul Dale Anderson
John Hall
David D. Levine
Mark Montoni
Jeff Dunteman (who?)

Our Man in Utah, Charles Galway, reports that he tried to attend Stanley Pons's famous March 23 press conference, but he was unable to get into the hall. He was forced to watch on closed circuit TV from another room. A friend of his did gain entrance to the main hall on the basis of a press card – from his **Traveller** game.

Meanwhile, in Detroit, Guy Wicker is working on cold fusion for Energy Conversion Devices, Inc. Guy says he has his own theory of how it works and that it should be possible to build a bomb based on his theory. At last report, Guy was eagerly awaiting delivery of a shipment of heavy water. God help us all.

ERRATA: In the last issue it was stated that the tabloid that Mark Hyde's wolfish grin showed up in was The Weekly World News. This is incorrect. It was actually The Close Up Sun.

Colleen Kobe and Duane Corpe have joined the ranks of GT parents with the April 3rd birth of their baby girl Melanie Erin Corpe. Congratulations to the happy parents! We hear that Melanie already plans to attend her first Berserker this July....

Some of you may have noticed that we have some new artwork gracing our pages. Well, it so happens that we stumbled upon a real talent, way out in the west 'burbs of Chicago. His name is John Paul MacNerland, and believe me, we are very happy to have him on board. Mary Lynn kept saying he was good, and now we know it's true. Best of all, when he handed us the finished art for this issue, he said "Okay, what can I do for the NEXT issue?" (!!!) Need we say more?! Welcome Paul!

Pyro Business

PYRO has been doing very well since we took over the reins last year, and so far, it shows no signs at all of slowing down. At first, we lost a lot of folks off the mailing list due to change of address or lack of interest. As of issue #41, we had stabilized at about 135 paying, active members, but since then our ranks have increased by an impressive 35%. We also achieved something wonderful since last issue: a balanced budget! Wow. This issue will set us back some though, since it is an unexpected double size. We debated long and hard about adding the extra pages, but we've been recieving so much fun stuff that we just couldn't do it any other way.

This brings me to a couple of very important matters. First, on behalf of all of us who are working on PYRO, I'd like to thank everyone who has responded so enthusiastically with articles. With that kind of support, PYRO has a very bright and interesting future. I would like to request however, that articles be tailored to fit our 10 page format. Some of the material we've gotten is both big and wonderful, which makes it very difficult to print the item in a timely fashion, mainly because large articles have to wait for the one big issue we do each year. The only other option would be to raise the subscription rate to cover to costs of doing larger issues. This would include billing folks for the difference on their present subscriptions. I would like very much to get folks' opinions on this, so I invite one and all to drop me a card and let me know how they feel. I will assume that if you don't opinionize, you agree with the potential changes. Remember, we want PYRO to grow and be self-supporting, and so far, it's doing just that.

Since this issue is going to put us in the red a bit, we invite folks to indulge in a bit of philanthropy to help us cover costs. This is NOT required and it can't be applied to your subscription, but it would sure help us keep larger issues coming your way.

The fall issue of PYRO will contain the new and improved Mob List which is a listing of all the subscribers and their addresses. If anyone has objections about their address appearing in the Mob List, they MUST notify me by the deadline for NEXT issue. Because of the prodigious size of the list, we can't print it more than once a year, but I would be amenable to sending more recent updates out to those who send along copying cost and postage.

BACK ISSUES!!!!

For those of you who are new to PYROTECHNICS, we have a limited supply of reprints and real back issues. Reprints will be labeled as such, but the back issues are the real item, sent to us by Jeff Duntemann from his archives, and when those are gone, they're gone. As money permits, we will continue to do reprints. There is a list elsewhere in this issue that details just which ones we have. Take note though,, we will only accept US Postage Stamps to purchase them. The exceptions to this rule are those who live outside the US. Domestic checks or money orders will be returned. Subscriptions are handled by a separate individual and can't be put together with an order for back issues. The stamps will be used to answer PYRO mail or send out future issues.

Forbidden Fruit

Lee Hart

Since its introduction I've lusted for an Apple Macintosh. It was a dream come true; my very own version of the Xerox Smalltalk machine I fell in love with at the University of Rochester. But I loath Apple's big-brother mentality too much to buy one. It's like knowing the girl of your dreams was the daughter of Adolph Hitler.

It's particularly maddening to see IBM polluting this generation of computers with endless clones of brain-damaged PCs; while the next generation is smothered by Apple's vicious attacks on anyone who tries to apply the same advanced technology that Apple stole from Xerox in the first place.

I decided that the world would be better off with Mac-clones than PC-clones. I am therefore designing a drop-in replacement board for a PC clone that runs BOTH Macintosh and PC software.

As part of my development effort, I needed an easy-to-modify test bed. I had several old Heathkit H89 computers lying around, and noticed that a Mac motherboard was the same size as Heath's; used the same supply voltages; and even had the same power connector. I simply replaced the Heath board with the Mac's, producing an instant Mac clone for about $400!

At first I named it "Mac Heath." But George Ewing observed that Mac Heath was the happy-go-lucky killer in the "3-Penny Opera," made famous by the song "Mac the Knife." Like Dr. Frankenstein, I have put a criminal's brain into the body of my H89. I therefore wrote the above bit of whimsy during the Halloween season, and renamed it "Forbidden Fruit" to hide my heinous crime.

I've been amazed by the responses it gets. Apple fanciers positively foam at the mouth. The Heath people went nuts, and paid me $1000 to write an article for "Remark," their user's group magazine. And people buy them; I'm now building my sixth system for a customer!

What I've got is a 100% Mac-compatible computer for 1/2 the price. It also cures the Mac's biggest shortcomings; it has a 12" monitor instead of 9"; room for two internal drives, Winchester (either 3-1/2" or 5-1/4"), and ample room and power for a myriad of accessories. One of my customers, Nathan Montes, has 2 megs of RAM, two 800K drives, a 60 meg Winchester, math co-processor, and expanded keyboard. There's no way a real Mac can hold all this without becoming an expensive toaster-oven.

It turns out that there is no shortage of used Mac parts. Since Apple's design philosophy provided no expansion sockets, the only way a customer could upgrade his system was to buy a whole new board. Apple didn't want his old board, so it hit the surplus market. Companies like Shreve Systems (318-865-6743) and Pre-Owned Electronics (800-274-5343) stock a complete line of parts to fix Macs, or even build one from scratch.

Used H89s run about $100, or $179 new (from California Digital). Computers don't rust out, so the only difference is if you mind a few scratches or wear and tear on the tube. They weigh about 40 lbs. and measure 17" wide, 13" high, and 19" deep (of which 6" is the keyboard shelf, which can be removed). Being Heathkits, quality and documentation are superb (the exact opposite of Apple's philosophy). The cabinet is 1/4" thick plastic, and the cover flips up for servicing. An ordinary screwdriver takes anything apart.

To me, the nicest thing is having everything in one box, with plenty of power, cooling, and room for tinkering. The keyboard sits on a 16" x 6" shelf, which fits a stock Mac or Mac-Plus keyboard. Aftermarket keyboards (mostly converted from PC-clones) are often bigger, so the keyboard shelf would be removed.

The front-panel has a cutout for two floppies, or a floppy and a Winchester (either 3-1/2" or 5-1/4"; the latter a bit cheaper).

Here's a shopping list if you'd like to grow your own Forbidden Fruit. The prices are those I know of today, and so subject to change (and do not include shipping or taxes). I assumed a 512K board, with a Dove MacSnap adding a SCSI port and 2 megabytes of RAM. This is functionally identical to a Mac-Plus, but costs less. The Mac-Plus doesn't become a better deal unless you want over 2 megs of RAM.

cost to build a system:	cheap	nifty	fancy
1. New H89 (California Digital)			$ 179
Used H89 (various sources)	$ 50	$ 100	
2. Mac logic board, 128K (Pre-Owned)	99		
Mac logic board, 512K (Pre-Owned)		249	
Mac logic board, Plus (Pre-Owned)			500
3. 64K ROMs (Pre-Owned, Shreve)	20		
128K ROMs (for HFS, 800K drives)		99	99
4. 400K Apple floppy drive (Pre-Owned)	49		
800K Apple floppy drive (Pre-Owned)			225
800K 3rd party floppy (Jameco)		179	
5. Apple mouse (Shreve)	65	65	
Turbo mouse (Shreve)			85
6. Apple Mac keyboard (Shreve)	65		
Apple Mac-Plus keyboard (Shreve)		165	
DataDesk Mac-101 keyboard (CMO)			189
7. Dove MacSnap SCSI + 2 Meg RAM		650	
SIMM modules for 4 Meg RAM			1280
8. 31Mb ST138N Winchester (Lyco)		325	
64Mb ST277N Winchester (Sunnyvale)			555
9. Misc. cables, etc. (various)	50	65	70
10. Labor (if I build it)	100	100	150
TOTALS:	$498	$1997	$3431

Obviously you can mix and match pieces to suit your actual needs. This is a pretty good deal, considering a similarlyequipped Mac would run $1000 more. And it doesn't have the large screen, cheap expansion, or all-in-one design of the "Forbidden Fruit." Plus, this is a lot more fun!

Lee A. Hart
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Dowagiac, MI 49048

phone 616-782-3980

The Monster Mac

Mutilated by Lee Hart

(sung to the tune of "The Monster Mash")

I was working in the lab, late one night,
when my eyes beheld an awesome sight.
I flipped on my Heath to process a byte,
but when it warmed up, to my delight...

(Refrain:) (It's now a Mac)
It's now a monster Mac.
(A monster Mac)
Must be the ultimate hack.
(The greatest hack)
Apple's sure to attack,
(The monster Mac)
Because the saving's a fact!

Once it was a Heathkit, square and gray,
but my trusty tools took its mind away.
In its place I installed a Mac motherboard
from a flea market bargain that Igor scored.

(refrain)

Instead of that "beep" that I've heard so long
It now powers up with a Macintosh "bong".
Its great glowing eye is twelve inches, not nine,
And that cavernous case makes expansion divine.

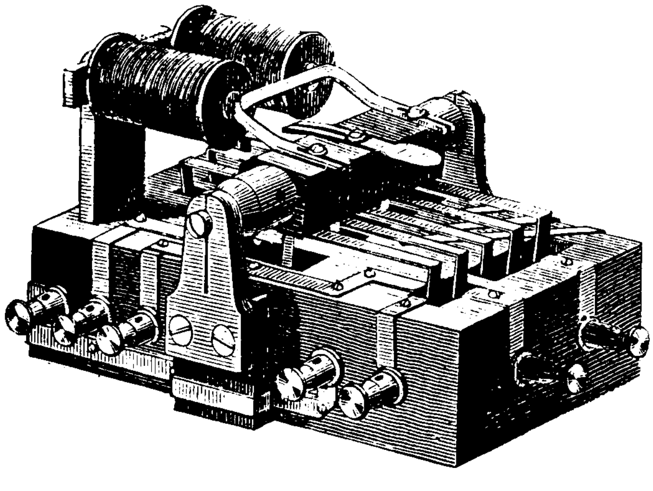
(refrain)

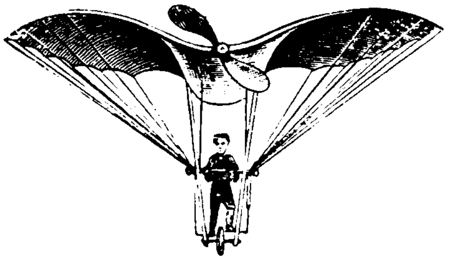
Now the graphics and fonts have gone to my head.
I put Mickey Mouse pictures in my letterhead.
And its voice synthesis is the joy of my life;
My computer talks back, like my kids and my wife.

(refrain)

Now the mouse and the games are all such fun,
But at last comes the time to get real work done.
Then I have to go back to my old CP/M,
which I run with the Mac's emulation program!

(refrain)





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from Pyro Joe's Hot Flashes, pp 137-151

copyright 1989, Jon Singer and Michael Butler

Now, kids, it's tahm ta talk about dee-layed gratification. Here's one that'll tickle ya pink! (Also black & blue if ya stand around it too long. Take a hint from ol' Joe.)

How menny	Whut is it	Where d'ya git it
1	1 inch cube of 90% Palladium with 10% Titanium	any good hardware store should have it, or special order fum Sears.
1	4 inch length of gold wahr	steal yore sister's earrin's
5 gallons	heavy water, with 10% DTO (th' "Jolt" version, heh heh.)	steal fum Navy base or borry fum naybors.
1 cup	Lithium Lye, with Deuterium, USGummint #3039924057394XD	war surplus store
1	1 to 3 volt, 30 amp pahr splah	hell, bild it, use pappy's arc welder, or whutever
1	special currint reggalater (figger 3, end of chapter)	bild it.
1	Kickass(tm) 8 week high-reliability timer or equiv'lint	Shoot, ain't you got a hardware bin? Call up Bud's Scientific Splah. Don't let on whut it's for.
1	big moonshahn crock, with lid.	c'mon, ya gotta know wher t' git basics!

th' usual wahr an' stuff, as requahred.

How d'ya do it, Joe?

Wal, ya find a ol' shack on a hill somewheres that still got pahr goin' to it. (Elsewise, y' got ta use a whole pile of ol' truck batt'ries, which is tuff ta hump around.) Put th' crock in th' shack, and pour th' Jolt water inta it. Stir in th' Lithium Lye, slow an' careful. Don't splash none, an' don't add th' stuff too quick, now. Cover it real taht, so's ya don't lose too much. Y'all don't wanna hafta sneak inta th' navybase again, do ya? Them guys got guns & stuff, and they ain't afraid ta use it.

So, ennyway, see, y' bild the pahr splah, an' y' bild th' currint reggalater in figger 3 at th' end o' th' chapter, the one with the special shunt cirkit fer changin' the currint. Thet's whar th' Kickass tahmer goes. Test it t' be sure that th' current starts at about 30 amps and goes down tuh mebbe 10 or 15 when th' tahmer goes off.

Bild th' other stuff lahk in figger 2. Cart th' whole mess down ter th' shack, and put th' "Bidness end" inter the Jolt water. Don't leave th' lid off too long, now. Cover it up good, an' duck tape it, specially th' place whur the wahrs come out. Ah got me some motorcycle ground strap, which is read'ly avail'ble an' flat, so it don't queer up th' fit o' the lid. Bolt the straps down real secure, an' put vaseline on th' bolts.

Now, set th' Kickass tahmer fer 8 weeks, plug th' pahr splah in, make sure y' got 30 amps, an' take a hike.

'Member, neutrons ain't yer frens. Keep ol' Blue away from th' shack unless ya want two-headed puppies runnin' around eatin' too much, probly worrit yore momma no end, an' if y'got t' go in ther t' check, don't stay long. You want ol' Joe's advice, atter mebbe 7 weeks, don't go in ther atall.

This-hear makes a real "hot flash", an' in fact, it's a prahm example o' whut this book is named fer. Y'all kin see th' flash from a couple mahls away, raht through th' av'ridge wall, so don't go bildin' it in yer basemit. Got thet? No need ta keep it too close ta home, raht? Y' kin get caught with it ef it's too close. Besides, y' don't want yer sister fahndin' out wher her earrin's got off ter. She probly woont lahk it, an' she'll make ya cut her in on the deal. 'Course, thet maht not be too bad, if she's good with a soldrn'ahrn. Probly bilds good pahr splahs, an that's importunt t' this 'hot flash'.

Youall have fun, now. Ef y' hit the sweet spot, th' hill will glow fer munths. Thet means you done real good! Set up a "Myst'ry Spot" sahn, an' charge th' city folks a dollar a look.

Yore Frend,
Joe

Ah got trouble, Joe. Naow whut?

Whut happen	Whut ta do
y' hair fall out in hanks	Dummy! Din't Ah tole you not t' stand around' up close-lahk? Thow away yer clothin', an' take lots o' shahrs. Eat some vitamin E, an' call th' doc ef'n it don't stop in a spell.
red skin & funny spots, bruise too easy	same thing.
juice won't drop to 10-15 amps	shunt circuit screwed up, or ya bought a cheap tahmer. Don't bah you no cheap tahmers!
no flash after 8 weeks is gone bah	th' Authority mebbe cut yer pahr. Wait 2 more weeks an' then check fer pahr at the wall sockit. Ef thet don't work, check the pahr splah. Ah tole yew yer sister probly bild it better then you, y' shoulda listened. Also check th' tahmer 'Member whut ah sed 'bout cheap ones!
Big wet spot	yer crock leak? If no leaks, check the roof. If the roof leaks, don't worry none. If th' crock leaks, fix it quick.
'lectrode turns brown	probly yer Lithium Lye is contaminatid. Ya can give it up, or start over.
runs hot	only happins once in a whahl. Swipe Grampa's ol' still-tubin', an' make lahk a li'l still coil with it. Jes' run th' outlet back inta the crock. Duck tape the whole mess real good. If thet ain't enuf, use a truck radiater. Don't drink the stuff, neither! Taste lahk hell, take it from one that knows.

Fusion Girl

Bill Higgins

For forty years physicists have been trying to achieve controlled nuclear fusion. They've been taking poor little nuclei of heavy hydrogen-- we call 'em "deuterons"-- and crashing them together with brute force. Just a little while ago the news came out of Utah that you could do fusion in a pickle jar, without a lot of expensive equipment. If this turns out to be true, it could be as important to energy production as good old Enrico Fermi's first reactor in the University of Chicago squash courts, way back when.

Fusion Girl
(Da Deuteron Ron)
Lyrics by Bill Higgins
Copyright 1989 by William S. Higgins

[To be sung to the tune of "Da Doo Ron Ron," by J. Barry, P. Spector, and E. Greenwich]

G C
I was working in the Fusion Lab late one night
D7 G
Da deuteron, ron, ron, da deuteron ron
G C
But I couldn't get my magnetic bottle to light
D7 G
Da deuteron, ron, ron, da deuteron ron
G C
Yeah, it was late at night
G D7
Yeah, it wouldn't light
G C
Yeah, she was a Fusion Girl
D7 G
Da deuteron, ron, ron, da deuteron ron

Then I met a chemist who was kinda pretty
Da deuteron, ron, ron, da deuteron ron
She told me that she came from Salt Lake City
Da deuteron, ron, ron, da deuteron ron
Yeah, she was kinda pretty
Yeah, she came from Salt Lake City
Yeah, she was a Fusion Girl
Da deuteron, ron, ron, da deuteron ron

She said, "You're wasting your time,
and you're bound to lose"
Da deuteron, ron, ron, da deuteron ron
"Let me introduce you to a new way to fuse"
Da deuteron, ron, ron, da deuteron ron
Yeah, you're bound to lose
Yeah, a new way to fuse
Yeah, she was a Fusion Girl
Da deuteron, ron, ron, da deuteron ron

What Fermi did under a stadium
Da deuteron, ron, ron, da deuteron ron
She did with heavy water and palladium
Da deuteron, ron, ron, da deuteron ron
Yeah, he had a stadium
Yeah, she had palladium
Yeah, she was a Fusion Girl
Da deuteron, ron, ron, da deuteron ron

We made it together and it was so sweet
Da deuteron, ron, ron, da deuteron ron
Just a few neutrons and a whole lotta heat
Da deuteron, ron, ron, da deuteron ron
Yeah, it was so sweet
Yeah, a lotta heat
Yeah, she was a Fusion Girl
Da deuteron, ron, ron, da deuteron ron

Fusion and all That Jazz
An Introduction for Non-Physicists

Dr. Barry Gehm

The recent brouhaha over cold fusion has accounted for a lot of distraction at editorial meetings and other GT get-togethers in the past couple months. Inevitably the conversation turns to the latest rumors on Usenet, the latest distortions appearing in the press. Speculative mechanisms, whose rigor ranges for gelatinous to superfluid, are propounded and rebuffed. Means of obtaining palladium and heavy water are discussed. The CRC is dragged down from the shelves amid arguments over isotopic ratios and mass defects.

And certain eyes glaze over, as some of those present wait for the conversation to turn to another topic.

Not everyone in GT studied nuclear physics in school. Some of us had to learn it in the gutter. Or worse, from the news media. For the non-physicists in the audience, here is a brief introduction to fusion, written by a non-physicist. Any physicists reading it are requested not to pick nits.

Everyone is probably familiar with the general layout of atoms: heavy, positively charged protons and uncharged neutrons in the nucleus, lightweight negatively charged electrons whirling around the vast distances away (comparatively speaking). One of the major puzzles that accompanied the discovery of this structure was what held the nucleus together. Having the same charge, the protons should repel each other and fly off, making it impossible to form any nucleus more complicated than hydrogen (1 proton plus 0, 1, or 2 neutrons). A new force of nature, stronger than the electrical repulsion of the protons , must be involved. Called the strong nuclear force (or just the strong force or strong interaction), it is one of the so-called fundamental forces of physics. (The others are gravity, electromagnetism, and the weak nuclear force.)

The strong force attracts protons and neutrons to each other, and keeps protons together in nuclei despite their electrical repulsion the way attraction to canapes can keep people who can't stand each other at the same party. It supplies the "binding energy" of the nucleus, holding it together. Roughly speaking, the binding energy is the energy difference between a bunch of protons and neutrons rolling around loose and the same protons and neutrons assembled into a nucleus.

One of the most important properties of the strong force is that it operates only over very short distances (about the diameter of an atomic nucleus, surprise, surprise), whereas gravity and electromagnetism have essentially infinite ranges. This means that if you manage to separate the nucleus into two pieces that are a slight distance apart (overcoming the binding energy) electrical repulsion will finish the job for you, driving the pieces away from each other at high speed. That's nuclear fission. Contrariwise, if you want to push two nuclei together and make them stick, you have to get them really close together – essentially touching – and you are fighting electrical repulsion all the way, so you have to push really hard (keep in mind that, because of the inverse square law, the electrical repulsion will quadruple each time you halve the distance). Squeezing nuclei together so that they form bigger nuclei is nuclear fusion (I knew we'd get to it eventually).

The question is, which will produce energy? Will the binding energy of the new bigger nucleus supply more energy than it took to squeeze two fusing nuclei together? If so, won't the energy required to break a nucleus apart be more than that obtainable from the electrical repulsion of the fragments? How can fission and fusion both produce energy? It depends mostly on how big the nuclei are.

There is a famous phrase (made more famous by John McPhee's book of the same title) "The curve of binding energy," that describes how tightly held the protons and neutrons are in nuclei of various sizes. Essentially, the tightest binding is found in the nuclei of medium size. like iron. Very large nuclei, like uranium, are held together somewhat more loosely (because of the distance limit of the strong nuclear force) and very small nuclei are held together considerably more loosely (because if they were bigger there could be more "nuclear bonds" formed by each proton and neutron). Therefore, the fusion of small nuclei into bigger (but not too big) nuclei, and the fission of large nuclei into smaller (but not too small) nuclei, are both energy releasing. Moving from either end of the curve of binding energy towards the middle produces energy.

Fission has one big disadvantage: all the extra neutrons. As the nuclei get bigger with more protons, they need a higher proportion of neutrons (which participate in the attractive string interaction but not in the repulsive electrical interaction) in order to be stable. When a large nucleus like uranium splits, some of the neutrons fly off by themselves, but the "daughter nuclei" have a lot more neutrons than is optimal for their size (neutrons are not particularly attracted to other neutrons, just to protons), and that makes them unstable, i.e., radioactive. That's why spent nuclear fuel rods and nuclear fallout are so much more radioactive than the original uranium or plutonium. Also, the neutrons that go flying away can hit other, ordinary nuclei and make them radioactive. Fission inevitably produces a lot of highly radioactive waste. Furthermore, fission depends on large nuclei, which are fairly rare, cosmically speaking (although uranium is a lot more common than you probably think), and it really doesn't produce much energy per gram of fuel, compared to fusion (the curve of binding energy is rather flat on the heavy-nuclei side). However, breaking things apart is always easier than putting things together, and fission is much easier to achieve than fusion. Hence we had A-bombs before H-bombs, and fission power plants are commonplace while fusion power plants are a dream.

Most of the work aimed at making that dream a reality has involved heating hydrogen isotopes to very high temperatures. In the sun, ordinary hydrogen (H^1 or protium – its nucleus consists of a single proton) under enormous heat and pressure fuses into He^4 (2 protons and 2 neutrons) in a multi-step reaction that consumes four hydrogen nuclei (2 of the protons are converted into neutrons). If neutrons are already present, the reaction is somewhat easier to bring about, and most fusion experiments use deuterium and tritium, isotopes of hydrogen that contain neutrons in their nuclei (see box).

Deuterium occurs naturally: 150 out of every million hydrogen atoms are deuterium. That may not sound like much, but there are a lot of hydrogen atoms on Earth, in the form of water. One of the great promises of fusion is the almost limitless supply of fuel present in the oceans. Tritium is radioactive with a half-life of only 12.6 years; it therefore occurs naturally in only the minutest traces and has to be produced artificially, but this is fairly easy to do (just expose deuterium to neutrons). Although using deuterium and tritium makes the fusion reaction easier to achieve, there is a disadvantage: some neutrons are released during fusion, so the materials around the reaction become radioactive. However, this problem is much less severe than in a fission reaction, because there are fewer neutrons released and because the products of the reaction are not themselves radioactive.

There is a problem with using high temperature to cause fusion: the fuel won't stay put. Heat produces random motion, and the nuclei fly in every direction, instead of sticking around near the other nuclei so they can collide with them and fuse. Thus we have a problem of confinement. Ordinary means of confinement, such as enclosing the reaction in a container, won't work (at least not very long) because the temperatures involved are much too high for any solid matter to exist. In the sun, the confinement issupplied by gravity, but this requires a massof hydrogen the size of a small star, which is inconvenient for the laboratory. The two major means of confinement in fusion research are inertial and magnetic confinement.

Inertial confinement essentially means that the fusion reaction takes place so quickly that the fuel doesn't have a chance to get away. This is the principle used in hydrogen bombs, but it can also be made to work on a smaller scale. A pellet of fusion fuel is blasted from all directions by intense laser beams (particle beams are also being tried). The sudden compression and heating produced by the beams triggers the fusion. This has been demonstrated successfully, but no one has yet managed to get enough energy out of the fusion to run the lasers, so it is a long way from practical power production.

Magnetic confinement takes advantage of the fact that anything hot enough to fuse is so hot that all the atoms have completely ionized – lost all their

ISOTOPES

Elements are distinguished by their atomic numbers, the number of protons in each nucleus: 1 proton makes hydrogen, 2 make helium, 6 make carbon and so on. The isotopes of an element differ in the number of neutrons they possess, and thus in the weight of the atom. Isotopes are usually identified by their mass number, the total number of protons and neutrons in the nucleus. Deuterium has one proton and one neutron, and so can also be called hydrogen-2, and symbolized H^2. Tritium, or hydrogen-3, H^3, has one proton and two neutrons. Hydrogen is unusual in that its isotopes are called by different names, instead of just mass numbers. [PYRO Quiz: what other element has separate names for its isotopes? The first reader to send the correct answer to PYRO will receive a certificate suitable for framing, declaring him or her to be a know-it-all.] "Heavy water" is deuterium oxide: water in which deuterium replaces ordinary hydrogen. It's 11% denser than ordinary water.

electrons – and so are positively charged bare nuclei. Anything with an electrical charge will bend its path when moving through a magnetic field, and if the field is appropriately shaped (and strong enough) the nuclei can be confined to a specific volume of space. The most successful magnetic confinement devices use toroidal (donut shaped) confinement chambers pioneered by the Soviets and are called tokamaks (a Russian acronym). The fusion fuel is introduced into the chamber as a plasma (a hot, ionized gas), further heated by electrical currents, and prevented from escaping by powerful magnetic fields. Unlike inertial confinement devices, which produce fusion in bursts, a tokamak can theoretically run continuously (in practice, they can only operate for a short time, because there are problems with the fuel leaking out of the magnetic "bottle"). Fusion has been achieved in tokamaks, but again, no one has gotten enough power out of one to be useful.

One of the major disadvantages with both approaches is that fusion reactions take place essentially in vacuum, isolated from their surroundings. This makes it difficult to make use of the energy created. Neutrons and gamma rays aren't very useful in themselves; we'd like to make electricity. The way we do that in coal- or fission-powered plants is very simple: boil water. Take the heat from an enery-producing reaction (chemical or nuclear) and use it to boil the water that makes the steam that goes through the turbine that turns the generator. Even if and when tokamaks or inertial confinement fusion reactors start producing significant amounts of energy, converting that energy into a useful form will be another major hurdle.

Hence, the furor when Martin Fleischman and Stanley Pons, two chemists from the University of Utah, claimed that they had apparently achieved fusion of deuterium at ordinary temperatures in simple equipment, that it produced very few neutrons, that it produced significantly more energy than it consumed, and that the energy was produced in the form of heat delivered to water.

At the same time, another group of researchers led by Steven Jones at Brigham Young University announced that they had also achieved room-temperature fusion using a very similar technique. Their claim was based on the production of neutrons and gamma rays; apparently they did not attempt to measure heat and did not observe any notable heat release.

One reason they would not have looked for heat is that the rate of fusion (as determined by neutron and gamma production) is so low that no measurable heat would be expected. This is also true of Fleischman and Pons's experiments. Ordinarily the fusion of two deuterium nuclei (deuterons) produces He^3 and a neutron, or H^3 and H^1, with roughly equal probabilities. If a large number of fusions take place, about half of them should produce neutrons. Either reaction also produces a gamma ray. The levels of neutrons and gamma rays detected by both groups are much too small (up to a billion times too small) to account for the amount of heat Fleischman and Pons report. Most of the "confirmations" that have been reported also are based on detection of small amounts of radiation, and not heat.

If Fleischman and Pons are correct, a previously unknown form of fusion has been discovered, and cheap energy may become the birthright of every human on the planet. If they are wrong about the heat but their and Jones's measurements of neutron and gamma flux are correct, cold fusion will probably never be more than a laboratory phenomenon, albeit of great significance to physics. It is even possible that the whole thing is a mistake, and cold fusion will join N rays and polywater in the archives of delusional science. For now, we can only wait and hope that this could be our big chance to bankrupt Exxon. [Actually, at least one GTer is doing more than waiting and hoping: see Quarks.]

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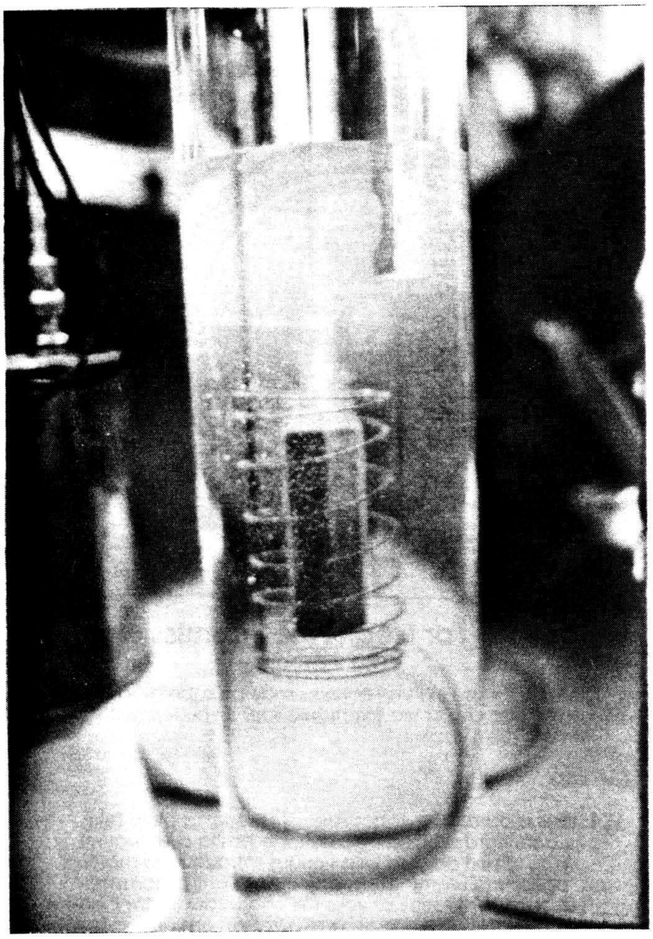
"FUSION. . . continued from page 1

The apparatus remained on the bench all that day, and being on the midnight shift, we were unable to supervise it. The next morning when people came in, we were told the results of our little joke. It seems that as each person saw it, they went and dragged their friends over to see their reactions, which varied from immediate laughter to amazement. Some walked up, dutifully standing behind the brick, and picked up the Geiger probe to position it closer to the cell (and farther from the real source) whereupon the count rate mysteriously fell to zero until they set the probe down again. The people that initially believed it brought other co-workers to see it, Presumably to reassure themselves that their friends were at least as gullible as they were.



The result was a continuous stream of people past the bench, culminating in an appearance that afternoon by the safety group brandishing a rad monitor on a long pole in front of them.

Apparently our little experiment had generated a chain reaction after all! However, (to our relief) there was no excess "heat" from our supervisor for having done it.

One friend remarked "I don't know whether to be flattered that all these people think our group is resourceful enough to put together a fusion reactor, or insulted that they think we're stupid enough to try it right here on the desk!".

The most amazing part of the whole thing was realized only when we were taking the thing down and cleaning up. For added realism, we had left a sheet of graph paper covered with strange curves next to the apparatus, as if we'd been making measurements on the "fusion rates".

The graph had been stolen.

Is or isn't it?

Why we don't know may be almost as important as what we don't know

Some random observations by

E. Michael Blake

What I'm writing at this moment will probably be outdated by the time it gets into print. That's one helluva situation for a science-fiction writer, but I'll have to live with it. It is May 10, and evidently no one who did not spend this past Monday night inside a crowd-controlled auditorium (cameras and recorders were banned) in Los Angeles has a full grasp of what B. Stanley Pons and Martin Fleischmann had to say about the experiments they have set up at the University of Utah (UU, for convenience here) since their original cold-fusion announcement on March 23.

Some snippets have been picked up by the general media from a press conference later on May 8; supposedly one test cell has maintained steady output of very high heat for at least one two-day interval, and one cell (the same one? a different one?) has, for a while at least, produced 50 times as much energy as had been put into it. Pons and Fleischmann responded to their critics, conceding a few points (such as that their gamma-ray measurements may not have been good enough to show significant neutron production), but suggesting also that some of the unsuccessful attempts to duplicate their work--MIT, Cal Tech, etc.--may not have employed large enough electrodes. Pons had also pointed out a few days earlier that a palladium electrode that is formed by casting is likely to work better than one that has been machined; in L.A., the UU team added that an electrode formed by processes that employ graphite molds or other carbon components could be poisoned by methane uptake. As for the complaints that the water in the UU cells has not been forcibly stirred (to prevent hot spots from skewing the heat measurements), Pons and Fleischmann simply stated that the water circulated sufficiently on its own.

I, of course, am not writing this from Los Angeles. Nor was I in Baltimore for the APS meeting, nor in Dallas for the ACS meeting, nor at any of the press conferences at universities and laboratories. I also won't be at the Los Alamos meeting on May 23-25, which will also be over with before this is printed. I have so far been able to attend only one cold-fusion-related event in person: a seminar on May 5 at Argonne National Laboratory, featuring Steven Earl Jones, head of the research group at Brigham Young University that pretty much had its thunder stolen when Pons and Fleischmann first went public.

This is rather frustrating, both because I am associate editor of Nuclear News and thus make my living writing about this sort of thing (and many other sorts, which is why I can't just suddenly fly off to any meeting or press conference), and because I want to write about it. I have a bachelor's in physics, and I essentially created the fusion beat at NN. It's an interesting and important field, and I want to do what I can to cover it clearly and accurately.

My whining over not being able to attend all these snazzy events and having to wait days or weeks for information is really just an outgrowth of what almost everyone faces when checking out cold fusion: Pons and Fleischmann just aren't devulging enough details. In the beginning, this seemed all right; they had to go through paper preparation, and it was possible (for me, at least) to pass off the press-conference bombast as the unwise choice of an overzealous university administration that has gained a regrettably large degree of control over two scientists' work. But then the paper appeared in the Journal of Electroanalytical Chemestry, with many details omitted, or attributed to result "to be published"--later, elsewhere. Then Pons and Fleischmann withdrew the paper they had submitted to Nature, reportedly because they said they didn't have time to respond to questions by the jury (though it was reported elsewhere that Fleischmann submitted about 19 pages of responses). And now, before a potentially friendly audience at the Electrochemical Society meeting in Los Angeles, Pons and Fleischmann apparently have continued to hold back details--even though doing so now, after the Baltimore Necktie Party (oops--I meant, the APS meeting), simply makes it look as though they don't have a strong case, and may have been wrong all along.

What is it with these guys? Are they under strict orders from the UU administration to stay clammed up? Is it all patent protection paranoia? Their assertions are now in real trouble, and not just because MIT, Cal Tech, and others haven't found evidence of cold fusion; apparently (excuse my incessant leaning on such fudge words) the information available to them hasn't allowed them to duplicate the UU conditions sufficiently. What hurts the Pons-Fleischmann case most is that there are other outside experiments with their imprint. Fleischmann advised on the set-up of cells at the Harwell lab in the United Kingdom, and Pons did the same for Los Alamos. So far, neither team has reported anything. Perhaps they're just better at keeping a lid on it than their collegues at other labs (and no, this is not a gag about whether a cell should be open or closed), but in the current promotional atmosphere that's difficult to believe.

Pons and Fleischmann know how science works. So do most, if not all, of the seekers after gold and glory who seem to be in charge of UU. It is clear that unless the experiment can be repeated by at least a few qualified, disinterested parties--and repeated completely, not just through reports of a few neutrons here and some heat or helium there--their claims will be dismissed. What then? Will UU try to develop and market a technology that nobody else believes in? Will it still try to get $25 million out of Congress? Will it even dare to spend the $5 million already approved by state legislature? Is this the overall strategy, to promulgate the notion that only these people at UU can make it work, and therefore only UU-licensed operations can ever generate cold fusion?

It may be that UU just doesn't think that patent protection would keep the discovery sufficiently limited. If the process can indeed be carried out on a small scale, it might be a very easy patent to violate or ignore--at least, UU might see it that way.

Since full disclosure does not seem to be on the way, I feel free to wonder if UU thinks that cold fusion is too big to be bound by the conventions of science. The March 23 press conference, held when there had been no journal publication of results (and when the JEC paper had only been tentatively accepted), looks like a symptom of that attitude. Maybe UU wants us to believe that cold fusion only works for them, so you have to deal with them, take what you're given in cheap energy, and ask no troublesome questions. I hope that isn't the case, but I present the speculation anyway.

Those of you who started to read this in the hope that I might actually present something about cold fusion, rather than vague conspiracy theories, deserve a reward. Despite the fact that I haven't been able to show up at all the grand events, I've learned a couple of things that aren't generally known. Here they are:

•The Soviet Union has backed off its earlier claims of confirmation. There had been announcements of experimental success from Moscow, Kiev, and Kharkov in April. What wasn't announced was that the results were later examined by a number of other Soviet scientists, who found the data to be insufficiently persuasive. I heard this from I.N. Golovin of the Kurchatov Institute, who was in the U.S. in late April to speak at a conference I was covering. The conference was a commemoration of the fifty years since the discovery of fission, and had nothing to do with fusion, hot or cold. But take a wild guess what the number one topic of general conversation was.

•Steve Jones of BYU didn't deserve the swipe he got in the editorial of the April 27 issue of Nature. At least indirectly, Nature had included both the BYU team and the UU team when it charged that nobody had done control experiments with light water, to determine if the same effect was observed regardless of the presence of deuterium. Jones told the Argonne seminar audience that he had indeed done such control experiments, and conveyed the fact to Nature; he also said that Nature had apologized to him personally, but hadn't done so thus far in print. (I note, however, that the same eduitorial scores a pretty strong point against Jones by noting that his neutron detector is custom built--so its results may not be measurable by any other detector, thus limiting the chances for repeatability.)

That isn't much, I'll admit. But by the time this is printed, the whole cold fusion issue might be so dead that none of it will matter to anyone anymore. I hope that's not the case, but I'm not in charge here.

P.S. Why won't Pons and Fleischmann let MIT test UU electrodes for helium-4? Or is that a dead issue now too?

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ACT 17, P.A. 1921 AS AMENDED
ACT 380, P.A. 1965

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TO BE COMPLETED BY CAMPER

Please print or type.

CAMPER NAME

NUMBER & STREET CITY, STATE & ZIP CODE

CAMPERS TELEPHONE NUMBER

RESERVATION IS SUBJECT TO THE FOLLOWING CONDITIONS

PARK ADDRESSES ARE ON REVERSE SIDE

NAME OF PARK AND CAMPGROUND (if applicable)

TYPE AND SIZE OF EQUIPMENT (check appropriate one)

☐ TENT
☐ TRAILER, LENGTH ____________ FT.
☐ VEHICLE CAMPER, LENGTH ________ FT.

☐ FAMILY ☐ GROUP ESTIMATED ARRIVAL TIME ________ ________ AM PM

1. ALL SITES WILL BE ASSIGNED BY THE PARK OFFICER. NO SPECIFIC SITE CAN BE GUARANTEED. THE CAMPSITE MAY NOT BE AVAILABLE PRIOR TO 3 P.M.
2. Reservations may be made for the calendar year anytime after January 1.
3. A separate application must be submitted for each campsite or period of time desired. A renewal past the reservation period cannot always be guaranteed. Full payment must accompany the application, including reservation fee.
4. Mail applications must be received by the park at least seven days prior to the beginning of the desired camping period in order to receive a mail confirmation.
5. Reservations must be made for the minimum period and not more than fifteen days. See required minimum on back.
6. Reservations may be made by mail, in person or by telephone.
7. A campsite can be occupied by only: a) one family consisting of father and or mother and unmarried children (two relatives may be considered as part of the family if not more than one shelter is required); or b) one group consisting of no more than four unrelated persons.
8. If it is necessary to cancel a reservation, it may be done by mail, telephone, or in person at the park headquarters.
9. If Notice of Cancellation is received at least 24 hours prior to beginning of reservation period, all charges except reservation fee will be refunded.
10. If Notice of Cancellation is received less than 24 hours prior to beginning of reservation period, the camper forfeits the reservation fee and the minimum nights camping fee.
11. After the reserved campsite has been occupied, no refund will be made for the minimum nights. If camper fails to claim his reservation or fails to cancel the reservation, no refund will be made.
12. Confirmed reservations will be held for 24 hours unless the park is notified of late arrival.
13. Camping fee is subject to change. If the fee is increased after application is confirmed, camper agrees to pay the difference at time of arrival.
14. A State Park Motor Vehicle Permit is required for entry into the park and may be purchased at the park.

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THE TOTAL NUMBER IN MY PARTY WILL BE ☐

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PLEASE SEND ________ (APMVP) x $10.00 FEE $________

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MAKE CHECK PAYABLE TO STATE OF MICHIGAN

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YOUR RESERVATION APPLICATION IS NOT CONFIRMED FOR REASON CHECKED BELOW.

1. ☐ Camping fee not enclosed. Resubmit application with payment of $________________.
2. ☐ Payment returned. Amount incorrect for number of days and rate stated. Correct amount should be $________________.
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McLAIN STATE PARK

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THERE COULD BE DISRUPTIONS IN THE NORMAL CAMPGROUND ROUTINE CAUSED BY CONSTRUCTION EQUIPMENT (BULLDOZERS, DUMP TRUCKS, ETC.). THE MAIN ACTIVITY WILL BE TAKING PLACE ADJACENT TO THE PRESENT MODERN CAMPGROUND. HOWEVER, ALL TRUCKS, ETC. WILL HAVE TO PASS THROUGH THE PRESENT CAMPGROUND TO REACH THE CONSTRUCTION SITE. ALSO, NEW UNDERGROUND 30 AMP ELECTRICAL SERVICE IS GOING TO BE INSTALLED IN THE ENTIRE CAMPGROUND (PRESENT & NEW) DURING THIS PERIOD. THERE COULD POSSIBABLY BE SOME PERIOD DURING THIS PHASE WHEN WE COULD BE WITHOUT POWER TO THE CAMPSITES.

WE WILL DO ALL WE CAN TO MINIMIZE THE INCONVENIENCES TO OUR USERS BUT WE DO WANT YOU TO BE AWARE OF WHAT WILL BE TAKING PLACE.

Ronald P. Racine

RONALD P. RACINE, MANAGER

R 1026
86

Jumbled I/O

Jeff Duntemann

(The Cajun hacker song;
with a bundle apology, mon, to Hank Williams)

Diablo, she gonna go, me-oh-my-oh;
She gonna take paint off the wall, go sky-high-oh;
Hazletine, sure sound mean, me-oh-my-oh;
Sunuvugun, gonna have big fun in the BIOS.

Chorus:
  Jumbled I/O, me-oh-my-oh, what the hell-oh,
  'Cause tonight I'm a-gonna make my machine go;
  Off she run, like a gun, then she die-oh;
  Sunuvugun, gonna have big fun, in the BIOS!

Me got a bone, pick on the phone, call Intel-oh,
'Cause when she write newline to LST she ring the bell-oh;
PIP to B:, FORMATs C:, then me cry-oh;
Sunuvugun, gonna have big fun, in the BIOS.

Chorus:

Plotter drum, she start to hum, disks is buzzin';
Error come up on the console by the dozen:
Bad sec-tor: accept, ignore, or retry-oh;
Sunuvugun, gonna have big fun, in the BIOS!

Chorus:

Jeff Duntemann

BERSERKER UPDATE!!!

As you can see by the form and letter that appear on pages 17 and 18, McLain State Park will be undergoing some changes. We have also been warned to get our campsite reservations in Early since there might be fewer of them this time. You can pull this form out of your issue of PYRO (gently!) and mail it along with the neccessary money to

McLain State Park
M-203
Hancock, Mich. 49930

(906) 482-0278

Dr. Techie

The winning question was sent in by John Hall of Rochester, New York:

"Dear Dr. Techie,
"It's 0 degrees F outside. The wind chill factor is below -30. The trees are coated with ice from yesterday's freezing rain.

"There is a little bird perched on a twig outside my window. He has his feathers all fluffed up to keep himself warm.

"Why don't his bare little toes freeze? My fingers do, and his toes are a *lot* worse off than them, square cube wise.

Signed, Frostbitten in Rochester"

We submitted John's question to Dr. Techie, who announced that he would first need to do "some control experiments". He confiscated the proceeds of the last PYRO bake sale and bought a bus ticket to Florida, where he was last seen chasing a flock of flamingos across a salt marsh with a rectal thermometer. In his absence, we turned the question over to noted wildlife enthusiast Mary Lynn Skirvin Johnson.

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Non-migratory birds are possessed of a quite unique and efficient method of circulation in their legs. Since John did not specify what kind of birds, I'm going to assume that he was talking about the little sparrow-like birds that seem to get along fine in even the bitterest of winters.

First, let's discuss the structure of the legs of perching birds. Aside from bones, tendons and tough, scaly skin, there is very little to freeze in the first place. All of the muscles that control the legs are high up and close to the body. The perching ability comes from a very interesting tendon-controlled 'locking' mechanism. When a bird perches, it sits low and close to the branch. The tendons tighten, causing the toes to curl in automatically. To leave the perch, the bird must first rise up so that the tendons in his legs release his grip on the perch.

This feature is coupled with the bird's heat-exchanging vascular system. The few blood vessels in the legs that sustain the skin (itself being hard, thick and keratinous like fingernails) are branched and interlocking. Blood vessels leaving the body are closely interwoven with the blood vessels returning to the body. This means that the blood is cooled as it leaves and warmed as it returns, thus conserving heat in the main portion of the body and maintaining the leg temperature at around one or two degrees above freezing. With little down there that needs to be warm in the first place, bird feet are already cold and if they ever get too cold, the little bird need only to sit on a perch and huddle down on his feet. The feathers around the stomach area are conveniently designed for keeping eggs warm during incubation, so heat is transmitted easily in this position.

John wins a Benson, Arizona T-shirt for his question, as soon as he tells us his size. Sore losers and procrastinators will be pleased to know that we're also offering a prize for next issue's Dr. Techie question. The reader who submits the best question will win a copy of Asimov's Biographical Encyclopedia of Science and Technology (paperback, first edition) so he can look things up for himself and stop bothering Dr. Techie. (Questions submitted for this issue's column will be retained for consideration.)

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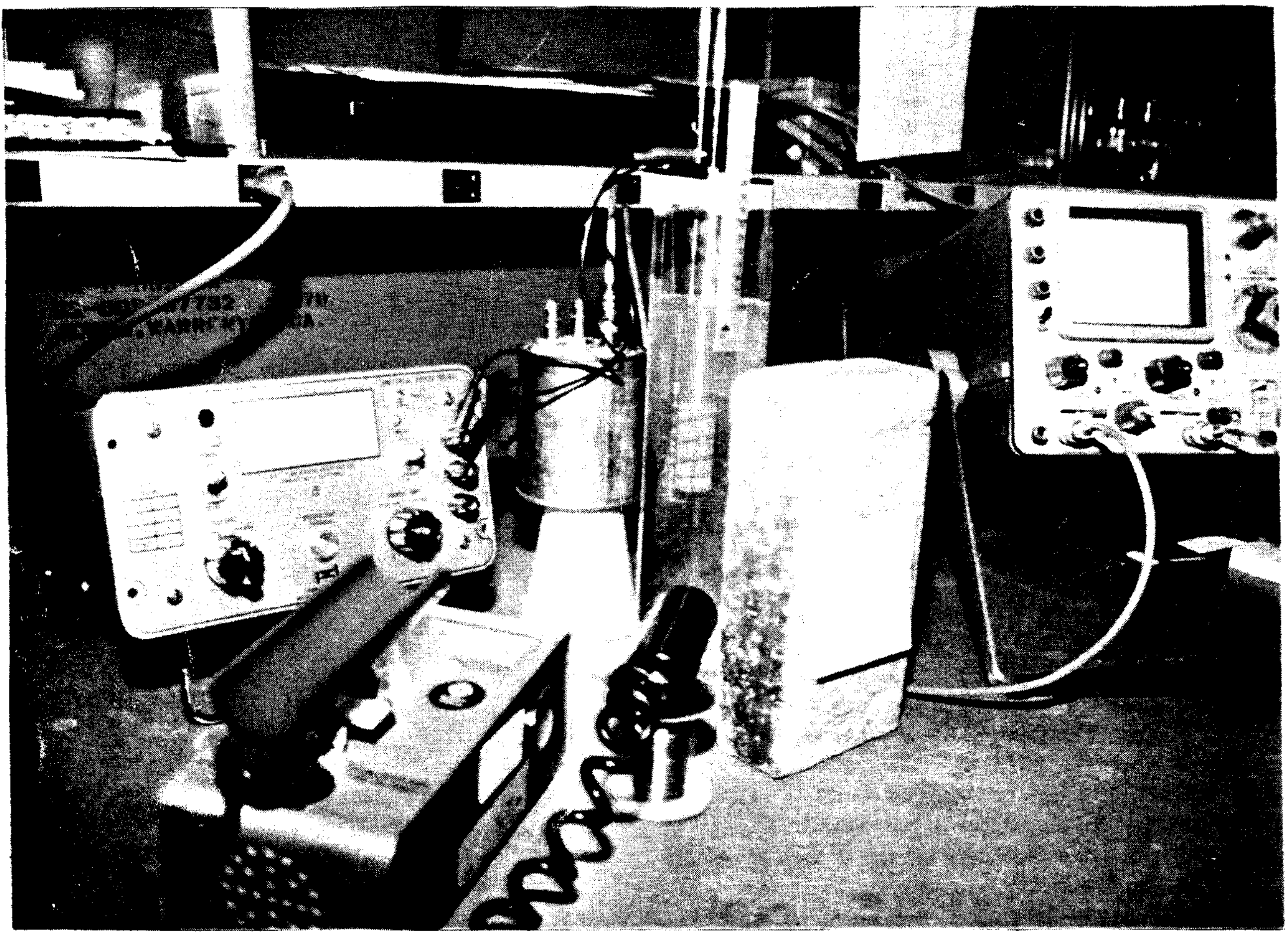
The Now & Then Newsletter of General Technics

COLD FUSION: Hoax Revealed!



by Todd Johnson

What with all the excitement about fusion this spring, CW Robertson and myself (the people who brought you the antiproton collider Christmas tree) decided that we would have to take advantage of the situation. Some of our co-workers have always been suspicious that certain people are out to get them, and their suspicions were to be verified.

Our plot involved scrounging up some plexiglas tubing and a few other goodies and assembling a credible imitation of a cold fusion experiment.

A chunk of aluminum (who knows what palladium looks like, anyway?) was mounted on a rod and positioned inside a section of miniature slinky, and a cheap thermometer was glued to a plastic support. This assembly hung down into the plexiglas tube which was filled with warm tap water. A spare radiation monitor normally used to measure beam loss in the Main Ring was placed behind the tube and connected to a scope which had a pulse signal fed in from another source to make it look like it was doing something. Placed near the "cell" was a portable Geiger counter which had a small calibration source attached. The probe was positioned so that it was picking up a few counts per second from the source and emitting ominous clicks. A power supply and a single lead brick bearing a sign reading "Please stand behind this brick" completed the apparatus.

This was put together on a midnight shift with the intent of letting the boss notice it when he came in. Unfortunatly, he didn't come in that day, but the one other person we wanted to catch with it did. Momentarily shocked, he soon realized what we had done and immediately went in search of victims.

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